JPRS-UAC-93-001
25 January 1993

FOREIGN
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JPRS Report

Central Eurasia

AVIATION & COSMONAUTICS

No 7, July 1992

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JPRS-UAC-92-001 CONTENTS *25 January 1993*

[The following are translations of selected articles in the Russian-language monthly journal AVIATSIYA I KOSMONAVTIKA published in Moscow. Refer to the table of contents for a listing of any articles not translated.]

Proposed Model for Development of Fighter Tactics *[Colonel Ye. Kulikovskiy; pp 4-5]* 1
Debates Continues on Training of Pilots in Critical Flight Modes *[Colonel (Retired) N.M. Lysenko; pp 6-7]* 2
Drawbacks in Military, Civilian Air Search-and-Rescue Decried *[Major-General G.V. Amelkin, E.L. Timonin; pp 10-11]* 5
Modeling of MiG-31 Crash Reveals Likely True Cause *[Colonel N. Ryabikov et al.*; p 13] 7
B-52 Visit to Russia Continues Building of Good Relations *[Colonel M. Syrtlanov; pp 14-15]* 9
Features of Ka-50, Modern Helicopter Strike Tactics Described *[S.V. Mikheyev; pp 18-21]* 10
Kosmoflot Venture Seeks to Occupy Major Position in Aerospace Markets *[S. Lvov and A. Lobanov; pp 34-35]* 14
Possible Joint Use of Glonass and Navstar-2 Navigational Satellites *[Colonel Yu. Rusakov and Colonel V. Gorev; pp 36-37]* 15
Table of Foreign Spacecraft Launches in 1991 *[S. Zlogodukhov, T. Bolshakova; pp 40-41, c3]* 18
Soviet Advisor Recounts Tactics of Early Air War in Vietnam *[Major-General of Aviation (Retired) M.I. Fesenko; pp 42-43]* 23
Articles Not Translated 25
Publication Data 25

Proposed Model for Development of Fighter Tactics

93UM0103A Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 7, Jul 92 (signed to press 14 Jun 92) pp 4-5

[Article by Military Pilot 1st Class Candidate of Military Sciences Colonel Ye. Kulikovskiy under the rubric "Tactics and Modeling": "If It Is Approached Creatively"]

[Text] The entry of new-generation aircraft and modern weaponry into service is introducing certain changes into the operational tactics of fighter aviation.

A constant striving of opposing sides to seize and maintain the initiative via the realization of one or several carefully tactical devices for aerial battle (TPVBs), developed on the ground and rehearsed on training flights, is typical of aerial battle. One quite often encounters in practice, however, a distorted depiction of the essence of TPVBs, when this concept is erroneously understood to mean various maneuvers (such as, for example, the "knot," "fork" or "mussel"), methods of attack of enemy aircraft, simplistic variations of aerial battle...

It would not be superfluous to recall in this regard that a "tactical device is the actions of crews (or subunits) in the air that are aimed at the unexpected and complete utilization of the combat capabilities of an aircraft and the conditions of the situation for the successful performance of a combat mission and to rule out losses from enemy actions." Such is the official definition as codified in the Combat Regulations. Let us try to look into how precisely it reveals the essence of TPVBs.

It must be noted, first and foremost, that certain means of enemy aerial attack could offer active resistance to our fighters in the course of combat operations (maneuver, fire, use of jamming), while others—by virtue of their specific features—cannot do so at all (cruise missiles and RPVs, among others). It is completely obvious that, in considering the problem of destroying the latter, there is no practical sense in talking about using this or that TPVB. In that case—more correctly, in my opinion—one must talk only about methods of attack of various aircraft. When the crews of our fighters enter into direct confrontation with an airborne enemy, they simply cannot get by without employing effective techniques.

All TPVBs for fighters, with a regard for the foregoing, may be divided into four groups according to dedicated purpose:

—**offensive** provide for the creation of conditions for the launch of guided missiles (or cannon fire) against an enemy aircraft from a tactically advantageous (or equivalent) position;

—**defensive** are utilized in cases where it is necessary to disrupt the attack of enemy interceptors, evade weapons they employ or get out of battle (with the complete expenditure of the ordnance load, limited fuel supply or damage to one's aircraft, among other things);

—**defensive-offensive** are employed for the purposes of getting out from under attack, with subsequent seizure of the initiative, and taking up a tactically advantageous position for attack; and

—**neutral (support)** TPVBs are a set of maneuvers whose execution creates conditions for the attack of an airborne enemy by the crews of other groups of fighters who are using their own tactical devices.

If we now "superimpose" the aforementioned definition of a TPVB onto each of the enumerated groups separately, the unequivocal conclusion suggests itself that it very narrowly reflects the essence and substance of the last three. I thus feel it expedient to consider two of these concepts in more detail apropos of aviation practice.

The essence in a general sense, as is well known, is a category that reflects the inner necessity and steady direction of this or that process—in other words, its foundation. In the case of a TPVB, it comprises the actions of the crews (pairs, flights) realizing a unique intent having a "spirit." It should moreover be taken into account that any intent should be oriented toward achieving a certain aim, based on the realization of one or several principles of aerial battle in the course of fulfillment of a tactical device (such as achieving surprise and ensuring the aggressiveness of actions, the employment of military artifice etc.).

As for the substance of a tactical device, then—as a category reflecting the aggregate of all the constituent elements of any process and its structural links—it is none other than a method of employing manpower and equipment aimed at finding efficient maneuvers for an impending battle, the skillful utilization by the pilots of the combat capabilities of their aircraft, their regard for the prevailing situation, the choice of a certain sequence in the operation of information and sighting equipment and on-board defensive and arms systems, and the creation of the necessary preconditions for the realization of subsequent tactical devices.

It may now be concluded with good reason that a TPVB is the actions of the crews (or subunits) that are directed at incarnating a distinctive battle intent, based on the realization of one or several principles of it and with a regard for the situation and the combat properties of the aircraft supporting the achievement of the assigned goal.

The birth of a TPVB is undoubtedly a creative process that does not lend itself to stereotypical approaches. It is also completely obvious that the fighter pilots will strive—in accordance with the specific situation that has taken shape at a given moment of the clash with an enemy—to employ tactical devices that are different in nature, but their substance should in any case be defined chiefly by the assigned combat mission (the dedicated aim).

Relying on the foregoing and without claiming to be the authority of last resort, I would nonetheless like to propose the most expedient sequence for developing a TPVB.

First, proceeding from the assumed operational tactics of enemy aviation, it is necessary to predict the composition of his tactical-purpose groups (GTN) and the types and parameters of their combat formations, and then—on the basis of the tactical performance characteristics of specific types of aircraft—to assess their information and "fire" potential and their capabilities for waging electronic warfare (EW).

Second, having analyzed the most likely tactical devices that an enemy may employ in a specific situation, a logical diagram of his actions should be devised (depending on their nature), and a method of achieving surprise for one's own attacks projected, based first of all on elements of military artifice.

Third, the area of possible initial engagement must be determined with a regard for the disposition of ground air-defense assets (one's own and the enemy's) and command and control points, and the effect on the degree of practical realization of the TPVB being developed of the terrain relief, the time of day, the forecasted weather conditions and other factors must be assessed.

Fourth, it is necessary to determine the types of battle formations on the basis of the overall intent of aerial battle, compute the parameters of maneuver of various GTNs, project a variation of the combat ordnance load for each of the variations in accordance with the conditions for the fulfillment of the attacks and the level of training of the flight crews, establish the modes and methods of application of individual EW gear and develop the procedure for disengagement, with a regard for its expected results and the possible reciprocal actions of enemy fighters.

It should not be forgotten that it is important at all stages of the development of a tactical device to devote attention to providing reliable command and control for dynamic battle, organizing continuous interaction among the subunits of fighters (GTN) and, after it takes on its final "shape," assessing its effectiveness according to the criterion selected.

It must also always be remembered that each of the TPVBs developed could ultimately prove to be decisive in determining the winner in an aerial clash. They should thus all be subjected, without exception, not only to careful gaming on the ground (both mentally and with the aid of computers), but also to rehearsal by the specific performers in a situation that is a close as possible to the realities of contemporary battle.

Debates Continues on Training of Pilots in Critical Flight Modes

93UM0103B Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 7, Jul 92 (signed to press 14 Jun 92) pp 6-7

[Article by Doctor of Technical Sciences Colonel (Retired) Nikolay Mikhaylovich Lysenko under the rubric "Combat Training and Flight Safety": "How Can Maximum Flight Modes Be Mastered?"]

[Text] *In the article "Teach the Spin" (AVIATSIYA I KOSMONAVTIKA No. 1, 1991), the authors favor the mastery of critical flight modes by flight personnel. They feel that if the likelihood of an aircraft's getting into a dangerous situation actually exists, the pilot must be given every change of getting out of it.*

Doctor of Technical Sciences Colonel (Retired) Nikolay Mikhaylovich Lysenko expresses his views on a solution to this problem.

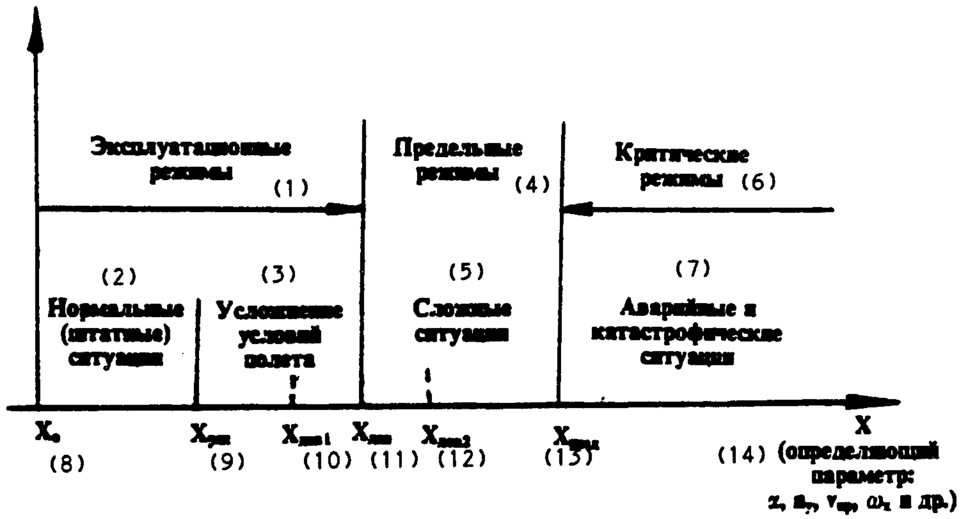
The maximum combat effectiveness of an aircraft is achieved only with the full utilization of all of its potential capabilities. The realization of this provision in practice is impossible, however, since tight restrictions on defining parameters such as angle of attack, normal G-forces, indicated airspeed and Mach number are established, for the purpose of ensuring flight safety, that restrict the realm of operational modes (see figure).

There occur, at the same time, cases of involuntary—and sometimes (in extreme cases) intentional—violations of them, with subsequent entry into maximum and critical modes, despite the use of modern systems for ensuring flight safety that are intended to avert exceeding the stipulated limitations on the parameters (X_{addl}).

Qualitative changes in the stability and controllability characteristics of an aircraft in the air are observed in the maximum realm, depending on the defining parameter (α, n_u, v_{max}, μ, ω_x etc.) and the magnitude that the allowable value of it is exceeded. A substantial decrease in the G-force stability of a combat aircraft with a subsequent entry into "grab," loss of directional stability and stalling, lateral rolling and a reciprocal roll reaction to the setting of the lateral control elements, among other things, could be noted, for example, when exceeding the allowable angle of attack depending on the aerodynamic configuration.

The flight personnel do not obtain practical skills in piloting not only in critical modes, but even at maximum ones under the existing system of training at the flight schools and conversion-training centers. A pilot who inadvertently gets into those modes, first and foremost by exceeding the allowable angle of attack, could aggravate a mistake by reacting reflexively, which frequently leads to a grave flight accident (LP).

A reasonable question arises, insofar as a favorable outcome is not fully guaranteed in mastering piloting in critical modes—is it worth training the flight personnel



Categorization of flight modes according to defining parameters

Key:
1. Operational modes
2. Normal (standard) situations
3. Complication of conditions of flight
4. Maximum modes
5. Complex situations
6. Critical modes
7. Emergency and crash situations
8. X_0
9. X_{mode}
10. $X_{addl\ 1}$
11. X_{addl}
12. $X_{addl\ 2}$
13. X_{max}
14. X (defining parameter: α, n_u, v_{max} and ω_x, among others)

in this at all? Would it not be more expedient to institute such tight restrictions on the angle of attack, supported by the command and control system, that the pilot could not exceed them even with a great desire to do so?

The answer here can only be an unequivocal one—the necessity of mastering the "prohibited" flight modes is determined not only by the possibility of getting into them and, consequently, the ability to pilot the aircraft therein, but also by the fact that under combat conditions—as the experience of Afghanistan showed—the desire to survive forces crews to perform maneuvers without considering the stipulated restrictions.

Whence follows a conclusion of no small importance—the existing system of instituting restrictions is far from perfect, and is in need of serious correction. And here is why. As has already been noted in the article "Is There a 'Golden Mean?'" (AVIATSIYA I KOSMONAVTIKA No. 6, 1990), one and the same restrictions are set for combat aircraft in both peacetime and wartime, while the principles for selecting them, after all, are different for each of the conditions. While priority is assigned to ensuring flight safety in peacetime, in wartime it is given to the achievement of high combat effectiveness. A contradiction that is difficult to resolve arises as a consequence of this: the preservation of an assigned level of safety in flight operations requires the establishment of possibly tighter restrictions on flight parameters, while ensuring high combat effectiveness requires the utmost expansion of the operational spectrum of the given parameters.

The restriction on the angle of attack by the SOS system on the MiG-29 fighter is 24° (for all cases!). A complete loss of lateral control of this aircraft is observed in some flight modes, meanwhile, at angles of 20—21°; this was, by the way, the cause of a number of flight accidents when maneuvering at low altitude and the appearance of additional instructions for the flight personnel on the observance of safety measures. Meanwhile, when it is necessary to evade a missile launched by an enemy, avoid collision with some obstacle or the like, for example, this aircraft can tolerate the brief and safe reaching of angles of attack of 32—35°.

We are losing an unjustifiably large quantity of aircraft in peacetime due to flight accidents, as shown by flight

practices and modeling, as the result of designated, uniform restrictions, while in wartime we will suffer excessively large combat losses. It is expedient to designate various restrictions for this reason (see figure): in the former case ($X_{addl\ 1}$) proceeding from the condition of an assigned level of flight safety, and in the latter ($X_{addl\ 2}$) proceeding from the condition of the maximum likelihood of fulfilling the combat mission. These are 20° and 32° respectively for the MiG-29.

The reservation should be made that the maximum value of the angle of attack ($\alpha_{addl\ 1}$), limited by the safe performance of a maneuver in peacetime, cannot be less than the values required to master the KBP [Combat Training Course]. Otherwise it becomes impossible without exceeding the stipulated limitations.

It would be a mistake to close our eyes to the fact that flight personnel will be forced to exceed the "prohibitions" imposed in wartime under combat conditions as well for the purpose of surviving or ensuring combat success. A special training course for the crews is thus required for piloting in maximum and critical flight modes that envisages both theoretical and practical training. Flight practice has confirmed that pilots, when getting into these modes and not possessing the essential skills and knowledge of the dynamic properties of the aircraft, act in the usual manner—which aggravates their situation—and rarely emerge the victors from the situation.

A pilot in a line unit, for example, brought his fighter to an angle of attack that corresponds to a loss of lateral controllability when performing a low-altitude roll with considerable G-forces. The aircraft thus "got hung up" in an upside-down position in the roll. In that situation, instead of letting the stick out somewhat (even a negative angle of attack is usually created when performing a controlled roll in order to maintain altitude in an upside-down position), restoring lateral controllability and then completing the performance of this maneuver, the pilot continued to put the stick into roll and pull back on it, reflexively increasing the angle of attack (and, consequently, the G-forces) until the moment of impact with the ground. A trained pilot, knowing the cause of the anomalous behavior of the aircraft, would first try to eliminate it and restore the controllability of the aircraft, after which the needed flight mode could be established.

The actions of test pilot V. Ryabiy in the failure of the power plant of the aircraft at takeoff are deserving of attention in this regard. Before ejection he kept the combat aircraft from going into a descent, increasing the angle of attack to the extent of the decline in speed. Having assessed that the aircraft would certainly hit a three-story building on its heading without a change in aircraft direction, the pilot tried to accomplish a breakoff. In view of the large increase in the angle of attack, however, the ailerons had lost their effectiveness completely. At the lowest possible altitude, Ryabiy decreased the angle of attack by pushing the stick (by which controllability was restored), turned away from the building and then in the roll safely abandoned the aircraft at the ground itself.

As has already been noted, while flight personnel glean some theoretical knowledge on the behavior of an aircraft in maximum and critical modes (in stalls or entry into a spin, for example) from textbooks, the Flight Operations Manual (RLE) or methodological texts, they have not been receiving practical training in them for more than ten years now. And it is far from easy to resume the discontinued training of pilots in these modes. One may agree in this regard with A. Shcherbakov, A. Klumov and A. Gorlov, who proposed in the article "Teach the Spin" that practical training start with the formation of a group of instructors and their training at a base of the Center for Flight Personnel Training of the LII [Flight Test Institute] of Civil Aviation or an analogous type of organization of the Air Forces, and then the training of flight instructors and flight personnel be started in the line units and educational institutions of the Air Forces.

Insofar as the theoretical training should be based on the results of flight testing, it requires somewhat of a change in the current program. The principal attention when researching the behavior of an aircraft at large angles of attack is currently devoted to an intentional spin mode and the development of methods to get out of it. Stalling in that case is considered to be a transitional process, and little attention is paid to it.

The RLE presents five methods of getting an aircraft out of a normal spin (a sixth is now being proposed—the oscillating, with "varying thrust"), three out of an upside-down spin and just one from a stall, regardless of the attitude of the aircraft and the type of maneuver in which the stall occurred.

Practice meanwhile shows that starting with the second-generation aircraft in the line units, not a single instance of getting out of an unintentional spin has been recorded, although there are instances of getting out of a stall. This has been officially explained by the lack of the necessary practical training among flight personnel. But that is not quite correct. Even a well-trained pilot requires 4—6 kilometers of altitude to get out of an inadvertent spin. If one takes into account that an unintentional entry into this critical mode, as a rule, occurs in active maneuvering at an altitude of 1—5 km, the principal cause of the failure to get out of it, even with the correct actions by the pilot, could be considered the insufficient altitude available. The training of flight personnel in the entry of a contemporary aircraft into a spin and escape from it, even at high altitudes, entails considerable risk and is scarcely justified for the considerations cited above. One therefore cannot agree with the aviation specialists who are trying to prove the necessity of the mandatory mastery of this critical flight mode by flight crews.

It would be advisable to place the focus in flight testing not on the intentional spin, but rather on the behavior of

the aircraft in an unintentional stall. Methods of pilot actions to avert the later entry of aircraft into spin modes, depending on the type of maneuver being performed and the attitude of the aircraft—that is, to halt the development of a dangerous situation after a stall—should be developed. It is namely that, I think, that should be taught to the military pilot.

Drawbacks in Military, Civilian Air Search-and-Rescue Decried

93UM0103C Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 7, Jul 92 (signed to press 14 Jun 92) pp 10-11

[Interview with YeG APSS Chief Major-General of Aviation Gennadiy Vasilyevich Amelkin and Search and Air Rescue Support Service for Flights of Air Transport Chief Ernest Lazarevich Timonin by Colonel S. Shumilo under the rubric "Topical Interview": "PSS: Hear Our SOS!"]

[Text] *The Unified State Air Search-and-Rescue Service (YeG APSS) was created in accordance with the decree of the USSR Council of Ministers of 29 Jul 76 to search for and rescue the crews and passengers of aircraft in air disasters. Since the issue is peoples' lives, it would be natural to assume that there are no problems in this sphere of aviation activity today. Is that so?*

Our correspondent discusses this with the chief of the YeG APSS, Major-General of Aviation Gennadiy Vasilyevich Amelkin, and the chief of the Search and Air Rescue Support Service for Flights of Air Transport, Ernest Lazarevich Timonin.

[S. Shumilo] We will start with the fact that the former Union does not exist, and there is accordingly no legally formulated unified airspace. What difficulties have arisen in the organization and performance of search-and-rescue operations in this regard?

G. Amelkin: Insofar as every passenger, not to mention the crew members, understands the naivete of believing in the absolute security of flights, he is nonetheless left with the hope of aid and the favorable outcome to any non-standard situation. There are unfortunately not yet any grounds for optimism. There is nothing to gladden the admirers of air travel.

Many of our former republics (Latvia, Lithuania and Estonia, among others), as well as individual regional aviation concerns (Magadan, for example), are refusing to take part in search-and-rescue support (PSO) for flights—as a rule making reference to financial difficulties—due to the collapse of the USSR and the dissolution of all-union ministries. It is difficult to understand that sort of economizing. But facts remain facts—sections of routes have arisen in the airspace of the CIS where a person can be left one on one with his own disaster. That situation naturally contradicts both the requirements of the ICAO and common sense.

Overall supervision of the performance of search-and-rescue operations is entrusted to the Air Forces command. That is where the first precondition destabilizing the PSS [Search-and-Rescue Service] arises. Its manpower and assets, after all, could be included in the overall cutbacks in a number of other army structures today. We cannot, of course, remain apathetic. We have sent constructive proposals to the highest authorities, including the Commander-in-Chief of the Combined Armed Forces of the CIS and the President of the Russian Federation, pertaining to the preparation of a draft agreement on the creation of an International Air and Space Search-and-Rescue Service. I hope they will be heard and realized, since as they say, time flies.

E. Timonin: I fully share the opinion of Gennadiy Vasilyevich. Certain specific features have taken shape in the activity of the rescue service of civil aviation at the same time. Coordinating actions in the performance of search-and-rescue operations (PSR) has become significantly more complicated. The boundaries of the areas of responsibility for flight PSO have narrowed in connection with the departure of the republics from the USSR and the independent business activity of certain aviation enterprises, for example the Karaganda and Ufa regional search-and-rescue services (RPSBs), which could lead to the appearance of "uncovered" sections of air routes.

[S. Shumilo] Cases are known where crews of aircraft that had gone down in bodies of water did not receive timely assistance due to the lack of direct radio communications between the naval and air rescue services. There are also cases of a different sort, for instance when help was not given in view of the fact that domestic aircraft were not equipped with radio sets that made it possible to listen in on the emergency frequency of 121.5 MHz during the performance of basic radio communications. In some such cases the disaster signals were received by the crews of foreign aircraft flying by, even though aircraft from Aeroflot were also in the sky at the time. Has that situation changed?

G. Amelkin: Whereas we used to have to send a representative of aviation to ships with their own radios even during search-and-rescue exercises, these radio communications exist today. Special instructions have been worked out and approved in accordance with international regulations for radio communications, after prolonged coordination with various ministries and agencies. A joint directive from the commanders-in-chief of the Air Forces and the Navy has moreover been promulgated on the organization of interaction between aviation and the fleet when performing search-and-rescue operations. The procedure for radio communications has been set forth in detail in the Air Search-and-Rescue Service Manual. Radio communications between aircraft and maritime vessels are conducted at a frequency of 123.1 MHz, and between aircraft also at the frequency of 130 MHz.

E. Timonin: What can I add? Maritime and air rescue craft, according to ICAO recommendations, should conduct radio communications at the uniform international frequency of 156.8 MHz. Aircraft of the Department of Air Transport and other agencies are currently not equipped with transceivers that operate at that frequency. The basic argument is that the indicated frequency is outside the "aviation" band of 100—150 MHz.

The crews of civil-aviation aircraft should listen to the emergency frequency of 121.5 MHz on certain stretches of routes at times that are free of regular radio communications. The Orlan-85 STA airborne radio set, which will be installed on new aircraft, is being developed at the request of the search and emergency-rescue services of air transport for the automatic reception of an emergency signal. It will issue sound and light information to the crew on the receipt of an emergency signal in automatic mode.

[S. Shumilo] You were talking about some shortcomings in the organization and performance of PSR that will, one would hope, be efficiently eliminated. It would be interesting to find out what technical gear the rescuers are equipped with, and what the level of their sophistication is. Who answers for the pursuit of a uniform technical policy?

G. Amelkin: You have asked, as they say, a painful question. The former union ministries and agencies, after all—such as the MGA [Ministry of Civil Aviation], MAP [Ministry of the Aviation Industry], MVD [Ministry of Internal Affairs], DOSAAF [All-Union Voluntary Society for Assistance to the Army, Air Forces and Navy of the USSR] and the KGB, among others—had air formations and maintained their own search-and-rescue subdivisions, including airborne, ground and parachute. A Coordinating Council under the chairmanship of the Air Forces Commander-in-Chief was created for the purpose of coordinating actions. The members of that council (representatives of the ministries and department) defined policy on issues of development, the issue of orders and the adoption of search, survival and rescue equipment into service. The technical level of that equipment was close to the world level overall. We have a considerable lag in some areas, however, more in a quantitative than a qualitative sense. The level of outfitting of the YeG APSS and the services of all the agencies with search and rescue gear has meanwhile always left something to be desired.

The prospects for their development are very problematical under contemporary conditions. The collapse of the USSR, the disintegration of economic ties and the insufficient financing have led to the fact that there have already been instances of a halt to the series production of some items. That is the case, for example, with the KAS-150 rescue containers that used to be put out in Latvia and do not come to us anymore. They were, after all, dropped by search-and-rescue aircraft to those who had gone down at sea.

Another example is emergency radio beacons. Who makes them? The casing for them is made in Dagestan, the radio gear in Belarus, the battery in Russia and various constituent items and components in Bashkiria, Armenia and other republics of the former USSR. The emergency-rescue items, as a rule, containing parts made of rubber, have a restricted storage time and operating life. That time has already passed for many of them, while deliveries have been cut back significantly. And if the question of resuming regular deliveries is not resolved in the near future, there will be nothing to rescue with.

E. Timonin: Questions of technical policy for the development and adoption of search and emergency-rescue equipment are defined by the Dedicated Comprehensive Program of Operations to Increase the Survivability of the Crews and Passengers of Aircraft in Air Accidents, which was approved by USSR Council of Ministers Decree No. 53 of 1988. That program is in the realization stage, despite the cutbacks in financing for individual scientific-research and experimental-design projects and the postponement of the deadlines for the fulfillment of a number of points in it.

[S. Shumilo] A last question for you, Ernest Lazarevich. All of our readers are in the role of passengers from time to time. What steps are being taken so as to ensure their safety?

E. Timonin: Despite the difficulties, a law is in effect in air transport that all flights of aircraft should be encompassed by search and emergency-rescue support. These requirements are set forth both in the regulating documents of the ICAO and in domestic ones as well. Search-and-rescue aircraft and helicopters are always on duty at airports, and there are non-standard emergency-rescue teams. Some 22 regional search-and-rescue bases have moreover been created, 17 of them in Russia. They have been manned by aircraft with crews having skills in the performance of evacuation work under difficult conditions and by regular rescue personnel with comprehensive training (parachute, medical, mountaineering and driving all types of transport used).

Here is just one example. A Bulgarian freighter ran aground and split in half when leaving the port of Tuapse as the result of a storm. An Mi-8MT search-and-rescue helicopter with rescue personnel on board took off from the RPSB at Adler. It ferried 30 crew members to Tuapse, one of them seriously ill, in three runs. The helicopter made a landing on the stern of the broken vessel.

From the editors. Yes, we live in a rapidly changing world. And not all the changes in it are for the better. One would like to be an optimist and believe that the problem touched on in our discussion will nonetheless be resolved. Various re-organizations of the higher structures of administration and the creation of new ones, however, do not dazzle us. The current changes also do not inspire confidence in their creative force. We all

remember how a State Commission of the USSR Council of Ministers for States of Emergency was created after the earthquake in Armenia by decision of the CPSU Central Committee Politburo, but it is difficult to cite any concrete fruits of its activity.

The Dedicated Comprehensive Program to Increase the Survivability of the Crews and Passengers of Aircraft in Air Accidents has been corrected and clarified several times. The result of each such correction was a reduction in the amount of operations, especially those that require large financial outlays. It is difficult to determine today what manpower from the YeG APSS will be pursuing technical policy in the development and adoption of search, rescue, survival and evacuation gear into service.

Our economic system does not impel the executives of air enterprises to consider human life as the highest priority anyway. The relatives of a victim will be paid 15,000 rubles by Russian Gosstrakh [State Insurance] in the event of a death in an air crash (it is much more expensive to ensure flight safety), while in the United States, for example, it is a minimum of 300,000 dollars. Questions of life insurance for military fliers have still not yet been resolved.

Modeling of MiG-31 Crash Reveals Likely True Cause

93UM0103D Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 7, Jul 92 (signed to press 14 Jun 92) p 13

[Article by Military Pilot-Expert Marksman Candidate of Military Sciences Colonel N. Ryabikov, Military Navigator-Expert Marksman Lieutenant-Colonel M. Subbotin and Senior Engineer-Researcher Lieutenant-Colonel S. Bolotin under the rubric "A Special Case—The Opinion of a Specialist": "So Just What Did Happen?"]

[Text] **From the investigation report of an accident of a MiG-31 aircraft that occurred on 31 Oct 91:** "A crew consisting of detachment commander Pilot 1st Class Major A. Loginov and navigation detachment Navigator 1st Class Captain M. Tretyak took off at 1739 hours from their base airfield to perform the practice drill 'Flight to Service Ceiling.' The aircraft entered the cloud cover after takeoff with the engines operating at full afterburner. It then came out of the clouds 6—8 seconds later on a descending trajectory. The collision with the ground occurred at an angle of 25° and with left bank of 65°. The crew was able to eject, but the aircraft was destroyed..."

From the report of Major Loginov: "Upon attaining a speed of 600 km/hr the afterburners were shut off. After that the aircraft spontaneously began to nose down, with no banking. The aircraft did not react to pulling back on the stick. Speed increased to approximately 700—750 km/hr, and the aircraft was then spontaneously thrown first upward and then downward. Rocking with G-forces of +3 to -1 with loss of altitude arose. I moved the stick back and forth, but the aircraft did not react to the movements. Before ejecting I let go of the stick—the aircraft pitched down sharply and I was pressed against the canopy."

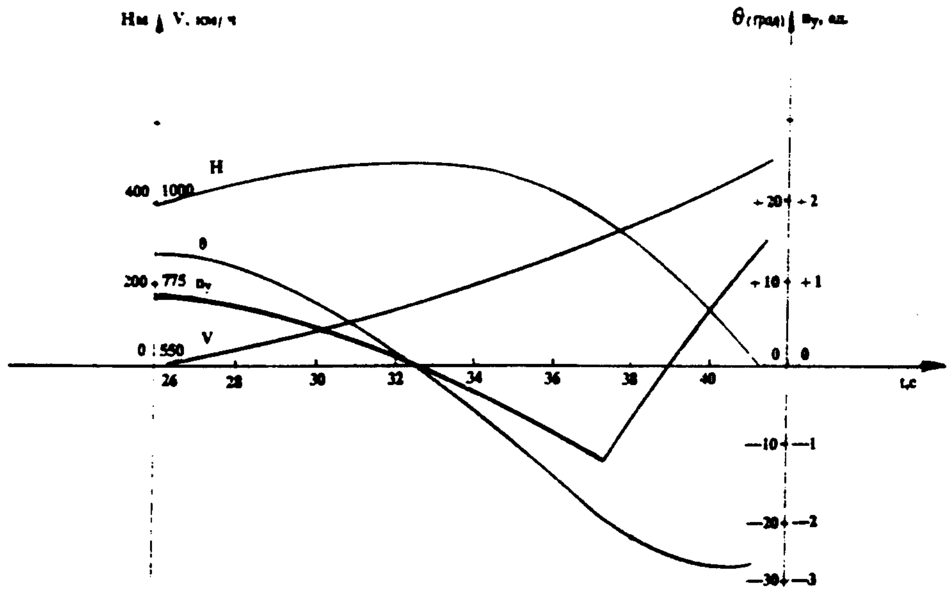
From the report of Captain Tretyak: "I was reading out the speeds every 50 km/hr. I monitored the lifting of the nose wheel, the separation of the aircraft and the retraction of the landing gear. The flaps were retracted at an altitude of 100 meters. The pitch angle increased to 15° and immediately dropped to -13° without banking. We entered the clouds. The command 'Dangerous altitude' came over the speech-warning indicator. I felt jolts in a lateral direction, and directed my attention to the airspeed indicator—the needle was at 950 km/hr and was moving rapidly down. I said, 'speed one thousand, afterburner,' and noticed the movement of the engine levers 'back.' The commander answered 'That is not the speed.' I got the impression that the afterburners had not been disengaged. Simultaneously, whistling from the left rear and glowing; the jolts continued.

I looked at the speed indicator—the needle crossed the 1,000 km/hr mark, and the angle of pitch reached -15°. The commander said, 'This control...' I was pressed into the seat, then against the canopy. I could not reach the ejection lever. I said, 'Let's eject.' I got the 'OK' from the commander and reached for the lever with my right hand, but I missed, tried with the left and missed again. I was separated from my seat. I was able to reach it under positive G-forces."

From the report of the working group to investigate the airframe and the control system, headed by Deputy Commander of the formation for IAS [aviation engineering service] Colonel N. Shustov: "No traces of fire before aircraft impact with the ground were detected in an inspection of the remaining elements of the airframe and the control system (rockers of the aileron control of the left wing, parts of the external covering of the wing fuel compartment). There were traces of flash burns from an explosion on individual parts of the airframe."

Conclusions from the results of investigation of the commission headed by Major-General of Aviation B. Khtey: "The causes of the flight accident are: giving the pilot a mission beyond his abilities; the lack of psychological readiness of the crew to perform the flight, which led to unrealized, incorrect actions leading to the descent of the aircraft, which was perceived by the pilot to be a loss of control. The aircraft hardware was free of defects and in good working order until the moment of impact with the ground."

These conclusions were not convincing to any of the pilots in the formation where the flight accident (LP) occurred. The more so as no psychologists were involved in the investigation, while the airframe and the control system were studied by a group under the leadership of



Results of modeling the parameters of aircraft movement

an official with a vested interest, which was intolerable in connection with the crew's doubts of the good working order of the aircraft.

From the testimony of eyewitnesses to the flight accident:

Private I. Miliyev: "...aside from the flame from the afterburner, I saw another burning area under the aircraft to the left between the engines. I was paying attention to that, since I had seen an aircraft taking off many times before, but never something like that. Something burning then separated from the aircraft..."

G. Artemyev: "..I observed light that was too bright, the bottom seemed to be illuminated with a bluish flame..."

M. Levkina: "... the aircraft was sparking, I even thought that they were launching missiles. It flew with a terrible grinding..."

And there were seven such witnesses! But the commission paid no attention to them. Why not? They had to find someone to blame. And they did. And the causes of the LP remained "buried in the ground" in the direct and the indirect senses—the "black box" was never found.

So just what did happen? We tried to find the answer to this question by modeling the situation on a computer. It was done by specialists in the unit where the LP occurred, "while the trail was warm," so to speak. The aerodynamic, thrust and balance characteristics of the MiG-31 aircraft and the flight control program were entered into the computer memory, along with data on the state of the atmosphere.

Two versions of control-system failure were considered: the first was a severing of the "stick—stabilizer" link in front of the stabilizer gearing mechanism (MPCh), and the second was a severing of the link after the MPCh and before the steering gear of the stabilizer control. The failure occurred during modeling in the 27th second of flight (start of decrease in the angle of pitch according to the report of the crew) with the following initial conditions: flight altitude of 400 meters, speed of 550 km/hr, pitch angle +15°, vertical G-forces (n_y) of 0.92 and engine operating mode at "full afterburner" (see figure).

The stabilizer shifted from a position of -5.5° to -2° in the first variation with the increase in flight speed to 750 km/hr. The aircraft was controlled therein according to the law of changes in G-forces depending on the flight speed.

The G-forces changed from 0.92 to -1.0 to -1.2 with the increase in speed to 850 km/hr, and the aircraft went into a descending flight trajectory. With a further increase in speed to 1,050—1,100 km/hr, n_y = 1.0, H = 0 meters and the angle of inclination of the trajectory Q = -24°, that is, in the 42nd second of flight the aircraft collided with the ground. The maximum altitude reached was 450—470 meters. The information "Maximum speed" was issued to the pilot at the speed of 720—750 km/hr depending on the pace of its increase. The ejection of the crew members took place in the 38th—39th seconds of flight at an altitude of approximately 300—200 meters and at n_y = -0.8 to -0.5. The time of flight t, according to the modeling materials, was 42 seconds and the distance covered was 7,120 meters, which corresponded to the actual data.

The results of modeling the second version differed substantially from the data of the actual flight. In this instance the slide valve of the steering gear of the stabilizer control was spontaneously set at the position at

which the angle of deflection of the stabilizer was close to zero with the aid of balancing loads. The negative G-forces decreased sharply—to -1.7 to -2—regardless of the stick loading in longitudinal control. The aircraft drops to a steeper trajectory, and its collision with the ground surface should occur at an angle of -35° to -40° in the 34th—36th second of flight, at less distance from the airfield than the actual incident.

The results of the modeling of control-systems failures with a severing of the link in front of the MPCh fully confirm this version, which was unwarrantedly rejected by the investigative commission, since no traces of severing were detected on the few bits of cable linkage that were found.

The cause of the severing of the stabilizer control line is presumably the spontaneous start-up of the turbine starter, which in the absence of a load reached elevated RPMs. A case of its spontaneous start-up in the air had already occurred in that same aviation unit, but the pilot averted its destruction by turning off the engine.

The version of the start-up of the turbine starter in the air is also confirmed, as you remember, by the words of the witnesses, who were roughly two kilometers from the airfield along the takeoff path and observed an additional brilliant glowing on the lower left part of the fuselage in the area of the engines, accompanied by an unaccustomed sound from the operation of the engines in afterburner mode.

Such were the conclusions according to the results of modeling. So what preventive measures have been taken in accordance with the actual fact of the LP? Two officers were relieved of their positions, one was written off of flight service—there are all the preventive measures...

B-52 Visit to Russia Continues Building of Good Relations

93UM0103E Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 7, Jul 92 (signed to press 14 Jun 92) pp 14-15

[Article by Colonel M. Syrtlanov under the rubric "An Alternative to Confrontation": "The B-52: *Persona Grata*"]

[Text] One probably need not be a specialist to understand why all strategic bombers, regardless of national affiliation, are under the vigilant monitoring of many CPs from the very first moment of flight. So the takeoff of two B-52s with a KC-10 tanker from a U.S. Air Force base on a March night was immediately recorded by modern detection equipment here. But even when there remained no doubts whatsoever of the ultimate routing of the aircraft that had intimidated us over the several decades of the Cold War, no duty operations officer gave the command for fighter intercept. The American pilots, after all, this time carried not a threat, but rather friendly congratulations to their Russian colleagues preparing to mark the 50th anniversary of long-range aviation. And what is a holiday without invited guests?!

One could, of course, relate in detail the unusual visit and the atmosphere in which it took place. But words cannot convey what can be seen from the photo report of our correspondents S. Pashkovskiy and S. Skrynnikov. It only remains for me to give the floor to the pilots of the two countries, who were quite recently naming each other as likely adversaries. Who knows, perhaps with time their opinions will enter the annals of new relations between our peoples. God willing!

Tu-22M aircraft commander Lieutenant-Colonel Viktor Zhibul (Moscow Military District): The crews of units in long-range aviation performing combat-training missions over the neutral waters of the world's oceans had had visual contacts with American pilots before. Such a flight was rarely made during my time of service in the Far East without our bombers being escorted by the fast Phantoms. What did we feel then? The usual human interest. Neither I nor my comrades personally had any hostility toward them. Soldiers are, after all, genial in nature if they are not doomed by someone's order to battle. They would not take such an order submissively today, by the way. My navigator, Major Vladimir Belovitskiy, for example, spoke quite definitively after his first flights for weapons delivery in Afghanistan of his role in those events: "Something here, boys, is not right..." And he was ultimately proven correct.

I ask that I be understood correctly. I am not calling into question the necessity of keeping our powder dry even today. But mutually advantageous collaboration in the professional realm is far more sensible than seclusion in politics.

Lieutenant-Colonel Bruce Slaughter (Virginia), chief of the Department for Russian and Eastern European Policy of the operations staff of the U.S. Air Force: This is not my first visit to Russia. I can thus compare the atmosphere of the prior meetings with that of these. It is gratifying that such contacts are being set up by the rank-and-file pilots of the United States rather than the generals for the first time since World War II. And they came not on a special flight on a civilian airliner, but on board military aircraft.

As for the reception, I was pleasantly struck by the openness and trust of the Russians in our exchanges—traditional national traits of the Russian character. Your state is experiencing a period of true resurrection of its culture, which was always founded on the common human values of the civilized world. That is also forcing us to reconsider our personal perceptions of the social changes that are taking place in the republics of the former USSR and to revise our stance of confrontation and suspicion.

One also cannot leave out the professional expediency of contacts among the pilots of the leading air powers. The

Russian pilots have also rightfully won a reputation around the whole world as true masters of their field. Your successes in the area of aircraft building are also unqualified. We thus do not hide the fact that we are hoping to glean something useful or necessary to us here as well.

Our experience is evidently also of interest to our colleagues. The participation of the U.S. Air Force fliers in supporting the combat operations of the multinational forces in the Persian Gulf, for example, is clearly of interest to all. It is no secret that many officers in our delegation proved themselves in excellent fashion in those events.

I myself took part in the Vietnam War, albeit at the concluding stages. I was engaged in the evacuation of civilians from Saigon to the Hawaiian Islands and the delivery of humanitarian aid for children, women and the elderly as part of the crew of a military-transport aircraft. So I know firsthand how much grief, misfortune and unhappiness violence brings. And since my fellow countrymen do not have, and cannot have, any grounds whatsoever for personal enmity toward Russians, one would like to believe that the course of collaboration of our great peoples will be everlasting.

* * *

The reply of the commanding general of the CIS Air Forces, Colonel-General of Aviation P. Deynekin, to a question on the prospects for the development of international ties between our fliers this year can serve as a summary of the unique dialogue between the Russian and American officers: "It is certainly splendid that the routings on which our aircraft carry out combat alert duty are today being assimilated for peaceful purposes. That policy is also in accord with the positive changes in the world, and serves as a solid guarantee of stability in the relations between the nations on planet Earth. They are awaiting visits from us in the United States, France, Turkey and Canada this year alone... It remains to be hoped that politics will not make any adjustments to these plans."

Features of Ka-50, Modern Helicopter Strike Tactics Described

93UM0103F Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 7, Jul 92 (signed to press 14 Jun 92) pp 18-21

[Article by VNTK [Helicopter Scientific and Technical Complex imeni N.I. Kamov] General Designer Doctor of Technical Sciences Sergey Viktorovich Mikheyev under the rubric "Domestic Aviation Technology": "The Ka-50: Concept, Combat Capabilities"]

[Text] *The Helicopter Scientific and Technical Complex imeni N.I. Kamov (VNTK), known around the world as the creator of the Ka-25, Ka-27 and Ka-29 shipboard combat helicopters, has built an army combat helicopter of a new generation. VNTK General Designer Doctor of Technical Sciences Sergey Viktorovich Mikheyev relates the concepts of its application and combat capabilities.*

The search for ways to neutralize the capabilities of armored troops under the conditions of contemporary warfare has led to the creation of new strike helicopters that possess high mobility and effective weaponry. The first helicopter of this class in our armed forces was the Mi-24.

The AH-64A Apache combat helicopter appeared in the United States roughly 15 years later. Its series production was preceded by several competitions among helicopter firms, with the building of experimental prototypes and the performance of comparative testing. The many years of work culminated in the birth of a craft that had a high level of effectiveness compared to the helicopter created at the Moscow Helicopter Plant imeni M.L. Mil (MVZ) at the beginning of the 1970s.

The Mi-24 completed a severe performance evaluation under combat conditions and, by and large, justified the hopes placed on it. The time has come, however, to replace it. The development of a new combat helicopter was entrusted to the MVZ and the VNTK on a competitive basis.

This was conditioned by the fact that a great deal of the necessary scientific, technical and production potential had been able to be accumulated at the VNTK in the process of design engineering for the Ka-25F close-support combat helicopter—in its time a competitor to the Mi-24—and the building of a whole series of ASW combat helicopters, along with the creation of the Ka-29 shipboard combat and transport helicopter.

A carefully substantiated conceptual framework for the combat application of the new helicopter from the VNTK, along with non-traditional approaches to design engineering, were required to see that it would surpass in effectiveness the AH-64 and the experimental prototype of a combat helicopter from the MVZ.

The main purpose of a combat strike helicopter in army aviation is well known to be destroying enemy armor and covering PVO [air-defense] assets in the form of gun and missile systems (AA artillery and SAM systems) from attack from the air. Two conditions should be fulfilled at a minimum in order to realize this purpose—having guided and non-guided missile and gun armaments available on board, and providing for the concealed approach to the jumping-off area for attacking the targets.

Flight to an assigned area or one selected at the discretion of the pilot includes two stages—concealed approach to the line of target search, and search and attack of the targets.

The first stage should be accomplished at the lowest possible flight altitude, making use of concealing features

of the terrain. This line is selected, as a rule, behind some natural concealment (mountains, hills, forests, ravines, structures and the like). The attack includes the helicopter's taking up of the initial position for aiming, the employment of the weaponry and subsequent withdrawal.

The conditions for the application of combat strike helicopters against ground targets covered by PVO are presented in stylized form in the figure. Their positions for attack using cannons and rockets in the joint lethal zones of AAA and SAM systems are designated by the number 1. The total time for enemy detection of the helicopter in this zone, preparation of PVO assets for use and the flight of a shell or missile to the helicopter is 10—15 seconds, defining the allowable duration of search and attack of the targets. The helicopter may be destroyed with a likelihood close to the unit value in the event this time is exceeded.

The number 2 designates the positions for the attack of targets using antitank guided missiles in the lethal zone of SAM systems, and the number 3 using antitank guided missile outside the boundaries of the effective lethal zone of PVO against airborne targets.

An analysis of the combat capabilities of the Mi-24 shows that it is able to attack targets only from positions 1 and 2. This is conditioned by the limited launching range of the antitank missiles (no more than five km [kilometers]). The attack of targets covered by PVO using antitank missiles from position 1 is impossible even in theory, as a consequence of the substantial overstepping of the allowable time for taking up the initial position, aiming, preparing the guided ordnance and guiding the missile onto the target.

Experience in utilizing various modifications of the Mi-24 showed that the piloting and navigation of the helicopter during the concealed approach to the target search and attack area at the lowest possible altitude (20—50 meters) is performed only by the pilot. The weapons officer effectively cannot perform orientation at that altitude and is not able in any way to assist the pilot, who moreover has an automatic cartographic plotting board at his position.

The pilot, on the other hand, cannot give any practical assistance to the weapons officer when using position 2 for attacking targets with antitank missiles, since he does not have a scan-and-search (OPS) system at his position. The flight altitude should be no less than 35—70 meters over level terrain, and 100-245 meters over gently rolling countryside, in order to ensure direct contact with a target from a line at four kilometers. These altitudes do not create any difficulties in piloting, as has been confirmed in practice during flight operations and the combat application of helicopter.

A comprehensive analysis of the results of combat application of these aircraft brought the specialists at VNTK to the conclusion that the creation of a single-seat combat strike helicopter able to surpass a two-seater in "cost—effectiveness" was advisable. Various configurations were considered—a single-rotor with a control rotor, tandem-rotor, side-by-side and co-axial.

The single-rotor configuration with a control rotor was deemed unacceptable proceeding from the experience of the use of domestic helicopters in the Republic of Afghanistan, owing to the poor combat endurance conditioned by it—roughly 30 percent of the combat losses occurred as a consequence of damage to the long transmission, control lines, tail rotor and highly loaded tail boom. The tail rotors were moreover destroyed by rocks and other objects lifted up when hovering and in takeoffs and landings by the airflow from the main rotor, as well as due to banging against nearby obstacles when maneuvering close to the ground. Analogous drawbacks of helicopters with tail rotors had been revealed even sooner, in the course of the conflict in Vietnam. There is thus in helicopter building a desire to move away from the "tyranny" of the tail rotor, and make use alternative versions to compensate for the torque from the main rotor. These include in particular the well assimilated fenestron (a fan in the tail) and co-axial main rotors.

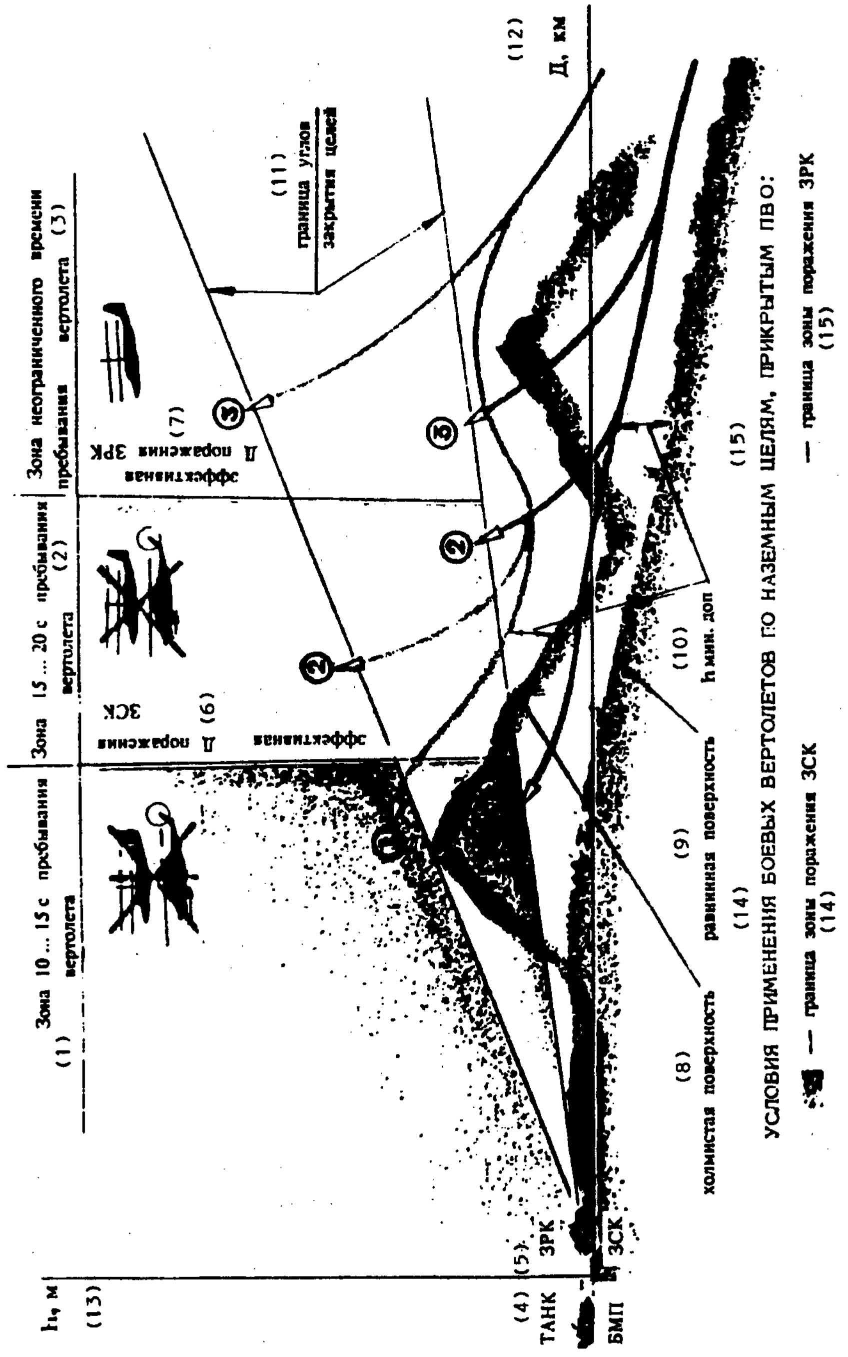
The tandem and side-by-side configurations proved to be unacceptable as well. The choice of the co-axial configuration thus remained, providing a higher efficiency factor compared to the single-rotor for a helicopter in hovering, at low speeds and when climbing, as well as allowing the achievement of significantly greater values for the static ceiling with equal engine power.

A helicopter with a co-axial configuration, possessing aerodynamic symmetry, is effectively lacking any cross couplings in the control channels, which makes the piloting simpler when executing maneuvers, including spatial maneuvers. One also cannot fail to note the advantage expressed herein in the possibility of completing a unique pedal turn across almost the entire range of flight speeds. When leaving an attack it reduces convergence with the enemy by 3—5 times compared to the conventional or accelerated turns used on helicopters with a tail rotor. This maneuver makes it possible to take up a position advantageous for an attack using cannon, antitank missiles or air-to-air missiles using the least amount of airspace when attacking airborne targets.

A helicopter with a co-axial configuration moreover has less visual and radar detectability as a consequence of its smaller dimensions.

All of the enumerated factors, and especially the ease of piloting a helicopter with a co-axial configuration, played a decisive role in the creation of the one-seat combat helicopter.

A unified sighting-piloting-navigational system with an OPS that supports target search from all positions (1, 2 and 3) and automatic guidance of the antitank missile onto the target was created for it for the first time in the domestic practice of helicopter building. The presence of a helmet-mounted system for target designation allowed the maximum unburdening of the pilot in controlling the OPS. After a launch and in the homing process of the antitank missile, the pilot is relieved of the necessity of



Conditions for the Use of Combat Helicopters Against Ground Targets Covered by Air Defenses:

Key:
1. Zone where helicopter can be present for 10—15 seconds
2. Zone where helicopter can be present for 15—20 seconds
3. Zone where helicopter can be present for unlimited time
4. Tank or APC
5. AA artillery or SAM system
6. Effective lethal range of AA artillery
7. Effective lethal range of SAM system
8. Hilly surface
9. Level surface
10. min. addl. h
11. Boundary of angles of target coverage
12. D, km
13. h, meters
14. Boundary of lethal zone of AA artillery
15. Boundary of lethal zone of SAM system

maintaining a certain trajectory of movement, and the helicopter can make movements in space both in altitude and in heading and alter its flight speed.

A supersonic antitank missile was specially developed for this helicopter, both supporting attacks on targets from outside the limits of the lethal zone of enemy SAM systems and providing a high likelihood of hitting small targets across the entire spectrum of launch ranges of the missiles.

All of the essential conditions for the use of guided antitank missiles by the pilot of a single-seat combat helicopter from line 2 no less effectively than is now able to be done using the existing two-seater were thus created. When attacking from line 3, the new helicopter has an overwhelming advantage as a consequence of the inability of the latter to execute the attack on targets from outside the limits of the PVO lethal zones.

The piloting of the helicopter at the lowest possible altitudes, right down to 10—15 meters over the terrain, for reaching the target search and attack area is simplified in comparison to to the Mi-24 thanks to the placement of the piloting information on a head-up display and the advantages of the co-axial system. The presence of piloting and sighting information on this display at the same time creates the opportunity for the more successful employment of cannons and rockets.

The cannon installation provides for effective fire from the single-seat helicopter. The pilot at short ranges uses an operating mode that is similar to the firing mode from the Mi-24P cannon. The pilot at long ranges can use an accurate automatic firing mode, in which aiming does not differ from aiming for the launch of an antitank missile.

The automatic mode is supported by deflection of the cannon according to the angle of site of the target on roughly the same scale as for the AH-64, and up to 15° on the azimuth. That made it possible to accommodate and rigidly attach the cannon against the right side close to the center of gravity of the helicopter, providing firing characteristics not achieved before. The good maneuvering properties of the helicopter (first and foremost a flat turn) are used to train it on targets that are located to the side of the direction of flight.

The cockpit is fully armored and is equipped with a K-37 ejection seat, effective at virtually any flight altitude, in order to protect the pilot against firearms and cannon armaments up to 20mm in caliber and to save him. The rotor blades are jettisoned before ejection. It must be noted that a pilot still does not have the opportunity of ejecting on any other helicopter in the world. Landing may be accomplished through the autorotation of the main rotors if necessary when the engines are not operating, as on other helicopters.

Modified engines that recommended themselves well in the process of operation on the Mi-24 and that are fitted with dust-protection and exhaust-screening devices have been installed on the Ka-50.

The three-strut landing gear with a nose wheel, which retracts in flight, makes it possible to reduce the aerodynamic resistance of the helicopter and its radar signature. Flight with the gear down is permitted across the whole range of speeds when piloting at the lowest possible altitudes, in case an emergency landing needs to be made.

The specialists at VNTK have devoted a great deal of attention to serviceability as well. The presence of a system for built-in monitoring of the operating condition, as well as convenient access to equipment, units and assemblies without the use of stepladders, will be judged on their on their merits by the IAS [aircraft engineering service] specialists in the line units.

The first flight of a Ka-50 took place on 17 Jun 82. The viability of the concept of a combat helicopter with a single crew member was confirmed by a great deal of modeling and the performance of hundreds of flights on a flying laboratory, as well as several thousand hours of flying time on experimental models and prototypes of the Ka-50 using the cannon, non-guided rockets and guided antitank missiles. It currently has no equal in terms of "cost—effectiveness."

The conclusion of the customer's test pilots that the helicopter is accessible to the pilots of line formations with average qualifications is the highest honor for its creators. One would wish the flight and engineering personnel of the line units the successful assimilation of the new-generation combat helicopter.

Principal Specifications and Performance Characteristics of the Ka-50

Top flight speed (in shallow dive), km/hr	350
Maximum G-forces	3
Static ceiling (away from influence of ground), meters	4,000
Vertical rate of climb at altitude of 2,500 meters, m/sec	10
Diameter of main rotor, meters	14.5
Length of helicopter with turning rotors, meters	16
Guided antitank missiles:	
—launch range, km	8—10
—armor penetration, mm	800 with dynamic protection
—homing system	laser
Cannon:	
—caliber, mm	30
—feed	selective
—ammunition load, rounds	up to 500
non-guided rockets:	
—caliber, mm	80
—number in units	up to 80

The use of other types of armaments is also possible.

Kosmoflot Venture Seeks to Occupy Major Position in Aerospace Markets

93UM0103G Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 7, Jul 92 (signed to press 14 Jun 92) pp 34-35

[Article by Kosmoflot AO [joint-stock company] General Director S. Lvov and Director of Marketing A. Lobanov under the rubric "The Problems of Conversion": "Potential Should Work"]

[Text] The political and economic situation of the present day dictates new rules that in some respects differ fundamentally from those that were unshakable and customary to all quite recently.

The paradox is that it is precisely those sectors that played the leading roles in the administrative era—the high-technology industry, heavy industry, the ubiquitously cited VPK [military-industrial complex]—that are lagging the most strongly of all in the economic race that has begun. It is namely in those sectors that the administrative style of management manifested itself most strongly, ensuring their preferential development. They were not always efficient, albeit streamlined, mechanisms with stable internal ties, existing cooperation and administrative structures that had been fine-tuned through many years of practice. The high degree of centralization and secrecy and the tight restrictions on independent commercial actions also led to an inability of "defense" to restructure itself in accordance with the situation.

This state of affairs naturally could not help but have a negative effect on the overall state of the sector. Many enterprises and associations, especially of a space thrust, were forced to seek access to the market through figureheads or small enterprises organized under larger structures and forming narrow "necks" linking the self-contained behemoths with the outside world. That is not saving them either, however, and the defense enterprises are losing the opportunity of looking like prestigious employers. They cannot now, as a rule, provide for growth in wages comparable with the pace of the inflationary rise in prices and a living minimum.

The largest associations are forced today to wage an intensive struggle for survival, the cost of which sometimes seems to be too high.

An unskilled orientation in a chaotic and burgeoning market often makes the producers of aerospace products economically helpless. To this is added the contradictions and disarray in many pieces of legislation.

These circumstances are impelling the enterprises to reduce the efficiency of deals (especially foreign-economic ones) through an acceleration of their completion, as a consequence of which many goods and technologies are going for nothing.

The most far-sighted executives are finding a way out of the situation in alliances with major financial and commercial structures with "reserves of strength" sufficient for long-term credit and the investment of major funds in production. It is often difficult for the financiers to understand the specific nature of the aviation industry, however, and that leads to the fact that interest is aroused by and large in projects that make it possible to turn around the invested funds quickly. Under conditions where the level of inflation exceeds 10 percent a month, it scarcely seems possible to achieve an investment policy without having solid arguments for the effects on the investors and creditors. An enterprise operating in isolation is not yet able to find such arguments, and the leadership in the "producer—investor" pairing thus belongs to the latter.

The natural reaction in such a situation is a desire to unite industrial and commercial structures for the purpose of creating a sphere of joint vested interest. Such associations have been cultivated exceedingly energetically of late, but often too much in haste.

As for the exchanges that have declared their aerospace specialization, they have still not acquired the necessary credit in trust so as to launch extensive activity. Too many such structures have moreover taken shape here. And obviously only those that possess the traditional exchange commodities—funds, power carriers, metals and building materials—will "survive."

Thus it obtains that despite the idea of unification and joint work on the formation of an aerospace market that looks extremely attractive in the eyes of many, the method of achieving that aim remains not entirely certain yet. Most likely, however, this sort of task can be accomplished by whoever knows how to create a parity association of which powerful financial, active commercial and leading industrial structures will all be a part, so as to rule out the possibility of any dictate from outside affecting the business and investment activity.

The Kosmoflot joint-stock company that was formed in April of this year—and whose president became Cosmonaut-2 G. Titov—could prove to be just that structure. Its founders include representatives of the three aforementioned areas. The financial capital is offered by the well-known Inkombank, the Industriya-Servis bank and the Investment Programs AO. On the commercial side are the Association of Joint Ventures, the Association of Private Entrepreneurs, the International Exchange and several major joint ventures. The aerospace sector is represented by major developers and producers—the Energiya NPO [Scientific-Production Association], the Molniya NPO, the Salyut KB [Design Bureau], the Almaz KB, the TsSKB [Central Special Design Bureau] (Samara), the Sovinformsputnik Association and many well-known plants—Arsenal (Saint Petersburg), the EMZ [Experimental Machine-Building Plant] imeni V. Myashchev and the Tushino Machine-Building Plant, among others. Many scientific-research and educational

institutions are also part of Kosmoflot, and should provide the necessary scientific and technical level of operations for the firm.

Kosmoflot as of today unites within itself features of a trading house and an export-investment company. Many specialists are in agreement on the fact that trading houses look more viable in competition with exchanges, having the possibility of flexible interaction with tax legislation and providing greater efficiency and adequate monitoring of the execution of deals. Kosmoflot as a trading house takes upon itself research and advertising work for a potential sales market and services in the sale of products that have completed preliminary expert appraisals. The founders of the joint-stock company enjoy considerable benefits therein, both in the sale and in particular in the advertising of the products and the performance of marketing.

Kosmoflot also intends to be actively engaged in investing in promising projects that are submitted for the consideration of a council of experts of the company. Well-known specialists in the most diverse sectors—from industry and sector and basic science to economics, banking and trading affairs—are part of that structure, comprising more than 50 people.

Kosmoflot has been forced under today's conditions to be oriented first and foremost toward attracting foreign investment, insofar as the continuing domestic economic instability is making ruble support for projects unreliable; the package of projects has turned out to be unexpectedly large (more than 30 financially substantiated projects were in the files of Kosmoflot as early as during the process of registering the company).

About ten major projects of both an aerospace and a conversion nature are currently at various stages of study. We have orders, for example, for the manufacture of precision panels for modernizing some radio telescopes and long-range communications antennas, as well as the creation of an air-transportable medical module that would include operating and diagnostics services. Israel intends to conclude a contract with us for the design engineering and construction of 100 wind-power installations, which could be employed to drill wells and in agriculture. The AvtoZiL Production Association has issued a large order for the manufacture of constituent items in Russia that have up until now been imported. The government of Kazakhstan, concerned for the future, is considering the question of implementing a project for an air-space craft and a small transport aircraft. Kosmoflot is moreover offering the projects of a small-tonnage yacht, enhanced-efficiency solar arrays and refrigeration units in which freon is not needed, as well as several other projects.

The forms of business can be most varied. Time will tell which of them is more viable under our conditions. We feel, however, that Kosmoflot will help to incarnate the activity of aerospace enterprises and make better use of their enormous potential for universal good.

Possible Joint Use of Glonass and Navstar-2 Navigational Satellites

93UM0103H Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 7, Jul 92 (signed to press 14 Jun 92) pp 36-37

[Article by Colonel Yu. Rusakov and Colonel V. Gorev under the rubric "Space Science—For the National Economy": "Global Navigational..."]

[Text] Man has since time immemorial needed in his everyday activity a means allowing him to determine his position on land, at sea and in the air reliably and simply. Various types of navigational instruments and systems have been developed and successfully utilized—magnetic, inertial, astronomical and ground radio, among others. They all have a number of substantial drawbacks, however. The magnetic means have little precision, the operation of astronomical systems depends on the time of day and the weather conditions, the ground radio navigation systems cannot provide global service for customers etc.

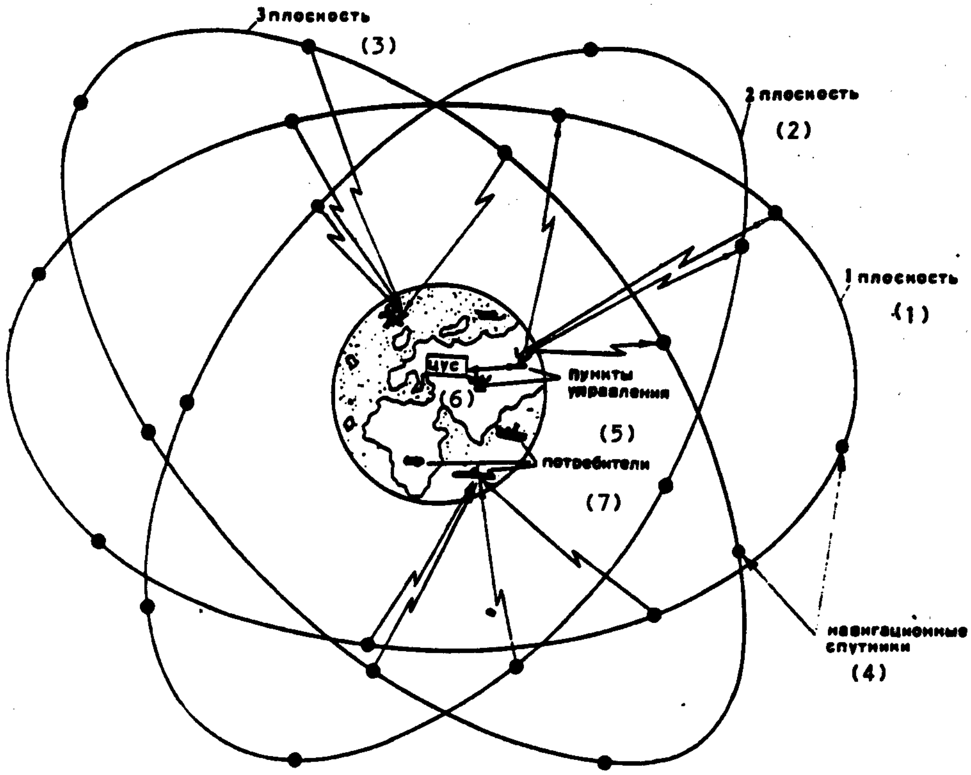
Modern navigational support should provide the opportunity of determining location at any point on the globe or in near-Earth space, at any time of day and regardless of the weather conditions, over a span of minutes, or even seconds with the maximum error in determining coordinates down to hundreds of meters.

Space radio-navigational systems were created for the fundamental solution of this problem. Fundamentally new points of reference are used in them—artificial Earth satellites positioned in a certain way in near-Earth orbits—as opposed to the traditional ones.

The first systems of this type appeared as early as the beginning of the assimilation of outer space, and were intended first and foremost for navigation by seagoing vessels. The domestic Tsikada system, providing for global navigational determinations with a discreteness of 1.5—2 hours at the equator and 20—30 minutes at the poles, can serve as an example.

Full-scale operations to create the second-generation Glonass global navigational satellite system were launched at the end of the 1970s and beginning of the 1980s. It consists of an orbital group of spacecraft, a ground command and control complex and customer navigational apparatus, as well as subsystems for customer navigational support.

The Glonass satellites are placed in orbits that are close to circular, with an orbital period of 11 hours 15 minutes. at 19,100 km [kilometers] above the Earth at an inclination of 64.8°. The fully deployed group should include 24 satellites (eight each in three orbital planes that are roughly 120° apart at the equator) and provide for the determination of position at any point on the globe at any moment in time. The maximum error does



Key:
1. plane 1
2. plane 2
3. plane 3
4. navigational satellites
5. control points
6. system control center
7. customers

not exceed 100 meters therein. The system, aside from the determination of position in three-dimensional space, also makes it possible to obtain information on the speed of an object in three coordinates with an error down to tens of centimeters per second, and to serve an unlimited number of customers. Each of its users can be supplied with special navigational gear that automatically and virtually instantaneously determines the coordinates and speed components according to information from four satellites, as well as making corrections in the time scale of its clock with a precision of parts of a microsecond.

The navigational report is transmitted from the satellite in the form of a stream of digital information, and includes the coordinates and speed vector components of the satellite in the rectangular Greenwich geocentric system of coordinates, corrections to the time scale, a "list" of craft that are operable at the given moment and other information (more than 25 parameters in all) necessary for navigational determination with the aid of the customers' responsor gear.

A series of difficult scientific and technical problems were solved in the course of design engineering and development of the system. Highly stable and small on-board frequency generators with a drift of about one second every million years, a system for high-precision—at the level of units of meters—determination and prediction of parameters of satellite movement and a complicated infrastructure for the ground command and control complex were all created in particular.

The Glonass system, having a dual purpose (military and economic), was created under an order from the Ministry of Defense by scientific-research institutes and enterprises in the defense sectors of industry. Its testing

was completed and the deployment of the orbital groups begun in 1991. Maintaining the system in operable condition and organizing its efficient utilization were entrusted to the space units. The preparation and launch of the launch vehicles for the spacecraft were carried out by the personnel at the Baykonur cosmodrome. The command and control of the on-board gear of the navigational satellites was accomplished by the Main Center of the Spacecraft Command, Control and Telemetry Complex. The command and control equipment includes the control center for the Glonass system, located in the Moscow area, as well as a network of individual command, control and telemetry complexes located across the country. A scientific and technical coordination center is being created for the purpose of rendering assistance to a host of potential users in mastering the Glonass system and organizing interaction among interested enterprises and agencies of this country and foreign customers in all aspects of its application and development.

The Glonass system makes it possible to perform a whole series of national-economic and scientific tasks at a qualitatively new level, and to obtain a considerable economic impact from its utilization.

The economy of operations is raised for seagoing vessels through the maintenance of an optimal schedule. The economy in fuel can reach 4,000—5,000 tonnes a year for large vessels.

Efficiency is increased for fishing vessels by no less than 30 percent through the precise determination of the locations to set their nets. The risk of running aground is reduced considerably in coastal regions.

The efficiency of the application of space navigational systems by ships being used in the search for minerals, for oceanography, geophysics, in the performance of operations to extract oil in regions remote from the shore, to measure the drift of icebergs etc. is exceedingly high.

Civil aviation pilots will be able, with the aid of the Glonass system, to perform precise navigational determinations on the routing over any point on the globe regardless of the altitude of the flight. The system, aside from the increased safety of air traffic, provides an opportunity to optimize overflight routes. The fact that the 10th Conference of the International Civil Aviation Organization proposed the joint utilization of the Glonass and Navstar (United States) satellite systems as the foundation of a future aeronavigational system testifies to the good market competitiveness of the Glonass satellites in the event of their application in the interests of civil aviation.

Both systems are very similar in characteristics. They not only operate in the same band of the frequency spectrum, but also transmit similar signals. An opportunity is created to use one receiver to work both with the American and our systems. The firm of Honeywell signed a preliminary agreement with Soviet organizations in May of 1990 for the development of a space navigational system to support flights by civil aviation. Agreement is expected to be reached within half a year on test flights by two experimental prototypes of the Glonass navigational receivers on aircraft of Northwest Airlines to check the accuracy, and then the parallel use, of the receivers of both systems. The development of this joint system is expected to be completed in 1993, with pre-operational testing in 1995.

The profits from the use of this global system in the interests of controlling civil air traffic and from the sale of receiving apparatus to third countries, according to various estimates by foreign specialists, could be several billion dollars.

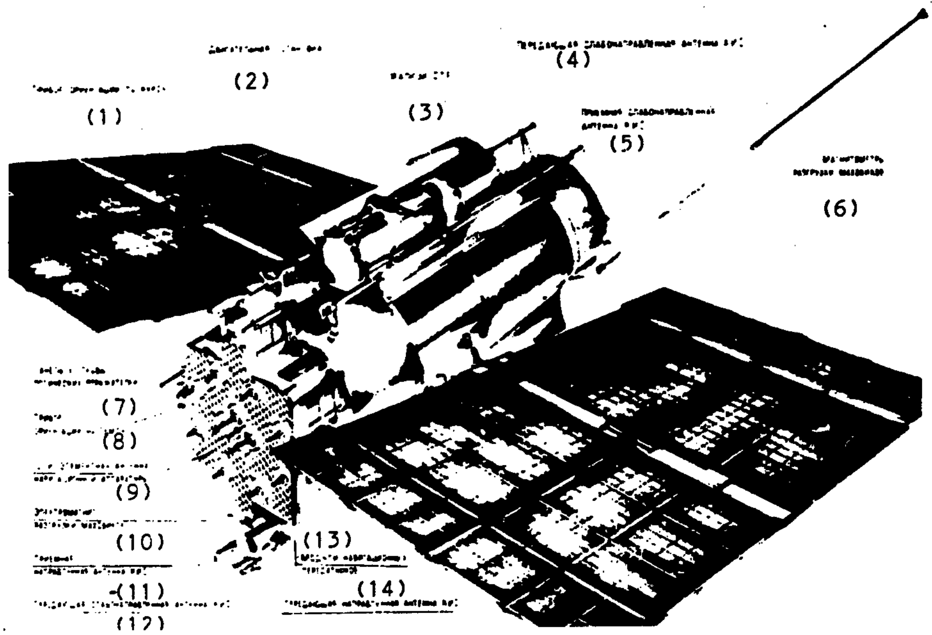
Prospects are being revealed in this regard for the more efficient utilization of means of transport. The planning of the optimal traffic routes—for example, in deserts and tundras—is becoming possible. The creation of a system of global monitoring of the routes of intercity and international motor transport is possible as part of a system with the space communications gear.

The use of the navigational gear in personal passenger transportation for the precise determination of locations in cities and on unfamiliar roads will also become a reality to the extent of reductions in cost of the gear.

The Glonass space navigational system is moreover irreplaceable in performing geodesic and geodynamic tasks on Earth. A world geodesic network, extended to difficult-to-access regions, could be created with its help. It will also help in determining the dimensions of our planet, determining the shifts in the poles, irregularities in its rotation etc. The use of this system in geology to link important sites and points of reference could increase sharply the accuracy of geological maps, reduce the time spent on surveying and increase the trustworthiness of predictions of drilling locations.

All of this makes it possible to consider the Glonass an effective system that meets the vital needs of the military, various sectors of the economy and international collaboration. Its creation and deployment are a real contribution of the military-industrial complex and the Ministry of Defense in raising the efficiency of the national economy and the defensive capability of the CIS countries.

Navstar-2 Satellite System	
Mass, kg	about 840
Frequency band of transmitter signals, MHz	1227.6—1575.4
Precision of connection of ephemeris time to world Greenwich, ms	11
Precision in determination of coordinates for civil customers, meters	about 100
Precision in determination of velocity vector components of customer, m/sec	0.12



Key:
1. course orientation instrument
2. engine installation
3. STR shutter
4. KIS widebeam transmitting antenna
5. KIS widebeam receiving antenna
6. flywheel shedding magnetometer
7. panel of corner optical reflectors
8. Earth orientation instrument
9. 12-element antenna of navigational gear
10. flywheel shedding electromagnet
11. KIS directional receiving antenna
12. KIS widebeam receiving antenna
13. modules of navigational transmitters
14. KIS directional transmitting antenna

Number of satellites in system	21
Orbital parameters: H = 20,000 km, i = 55°, T = 11.9 hr	
Glonass Satellite System	
Mass, kg	about 1,300
Frequency band of transmitter signals, MHz	1602.6—1615.5
Precision of connection of ephemeris time to world Greenwich, ms	5
Precision in determination of coordinates for civil customers, meters	no worse than 100
Precision in determination of velocity vector components of customer, m/sec	no worse than 0.15
Number of satellites in system	24
Orbital parameters: H = 19,100 km, i = 64.8°, T = 11.25 hr	

Table of Foreign Spacecraft Launches in 1991

93UM0103I Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 7, Jul 92 (signed to press 14 Jun 92) pp 40-41, c3

[Table compiled by S. Zlogodukhov and T. Bolshakova under the rubric "By Reader Request": "Table of Spacecraft Launches Abroad in 1991"]

[Text] *The feature in AVIATSIYA I KOSMONAVTIKA No. 6 of last year on the launches of spacecraft abroad in 1990 elicited great interest. Meeting the wishes of the readers, we offer here the analogous information for 1991. It was compiled by S. Zlogodukhov and T. Bolshakova.*

Table of Spacecraft Launches Abroad in 1991

			Initial parameters of orbit				
Date and place of launch	Means of ascent (launch vehicle, shuttle)	Name of spacecraft, agency, country	Minimum altitude, km	Maximum altitude, km	Inclination, degrees	Orbital period, min	Notes
1	2	3	4	5	6	7	8
January 7. Kennedy Space Center, United States	Delta-2	"NATO-4A," NATO	close to stationary orbit				military communications system satellite. Supports communications of military-political leadership of the alliance and the member countries
January 16. Kourou Space Center, French Guiana	Ariane-44L	"Eutelsat-2," West European Eutelsat consortium	close to stationary orbit				commercial communications satellite. Launch mass 1,625 kg, body diameter 2.5 meters, nominal operational life up to 10 years
		"Italsat-1," Ministry of Communications, Italy	close to stationary orbit				national communications system satellite
March 3. Kourou Space Center, French Guiana	Ariane-44L	"Astra-1B," SES consortium, Luxembourg	close to stationary orbit				communications satellite intended for direct television broadcasting
		"MOP-2," European Space Agency	close to stationary orbit				weather surveillance satellite
March 8. Western Test Range, United States	Titan-4	secret satellite, U.S. Department of Defense	433	681	68	95.7	presumably an electronic intelligence satellite
March 8. Kennedy Space Center, United States	Delta-2	"INMARSAT-2," INMARSAT international consortium	close to stationary orbit				satellite intended for supporting the communications of maritime vessels and aircraft. Launch mass 1,162 kg, dimensions 2.55 x 1.86 x 1.48 meters, nominal operating life of 10 years
April 5. Kennedy Space Center, United States	Space shuttle (Atlantis orbiter)	"GRO," NASA, United States	450	450	28.5	93.4	observation satellite for experiments in the little-studied gamma range of the spectrum
April 5. Kourou Space Center, French Guiana	Ariane-4	"Anik-E2," Telecom government consortium, Canada	close to stationary orbit				national communications system satellite. Launch mass 2,900 kg
April 12. Kennedy Space Center, United States	Delta-2	"Amersat-2," privately owned, United States	close to stationary orbit				commercial communications satellite. Launch mass 1,260 kg, dimensions 1.95 x 1.95 x 2.6 meters, nominal operational life 7.5 years
April 19. Kennedy Space Center, United States	Atlas-2	"BS-3H," NASDA, Japan	failed launch				communications satellite

Table of Spacecraft Launches Abroad in 1991 (Continued)

			Initial parameters of orbit				
Date and place of launch	**Means of ascent (launch vehicle, shuttle)**	**Name of spacecraft, agency, country**	**Minimum altitude, km**	**Maximum altitude, km**	**Inclination, degrees**	**Orbital period, min**	**Notes**
April 28. Kennedy Space Center, United States	Space Shuttle (Discovery orbiter)	"SPAS," NASA, United States	260	260	57	89.6	platform satellite intended for the performance of experiments to determine the spectral characteristics of missile flares. Mass 1,805 kg
		"KPC-A," "KPC-B," "KPC-C," NASA, United States	260	260	57	89.6	satellites intended for the performance of spectral analysis of the components of rocket fuel in space. Mass 75—85 kg
May 14. Western Test Range, United States	Atlas-E	"NOAA-D," U.S. NOAA	805	805	98.5	102	weather surveillance satellite. Launch mass 1,690 kg, length 3.71 meters, diameter 1.88 meters, nominal operational life 2 years
May 29. Kennedy Space Center, United States	Delta-2	"Aurora-2," privately owned, United States	close to stationary orbit				commercial communications satellite; has 24 repeaters on board
June 5. Kennedy Space Center, United States	Space Shuttle (Columbia orbiter)	"Spacelab," NASA, United States	276	303	39	90.2	airtight module for medical and biological research with animals on board. Mass 10,000 kg, length 7 meters, diameter 5 meters
June 29. Western Test Range, United States	Scout	"REKS," U.S. Department of Defense	796	885	89.5	100	research satellite intended for studying the nature of influences on communications gear
July 3. Eastern Test Range, United States	Delta-2	"NAVSTAR," U.S. Department of Defense	20,000	20,000	55	718	eleventh satellite of the NAVSTAR GPS navigational and geodesic global support system. Launch mass 1,700 kg, length 1.6 meters, diameter 0.8 meters, nominal operational life 7.5 years
		"LOSAT-X," U.S. Department of Defense	400	419	39.9	92.6	research satellite intended for the performance of SDI experiments. Mass 45 kg
July 17. Kourou Space Center, French Guiana	Ariane-40	"ERS-1," European Space Agency	780	811	98.4	100.5	remote sounding satellite. Mass 2,380 kg, dimensions 12 x 12 x 3 meters
		"Tubsat," Berlin Technical University, FRG	776	796	98.4	100.4	research satellite

Table of Spacecraft Launches Abroad in 1991 (Continued)

			Initial parameters of orbit				
Date and place of launch	**Means of ascent (launch vehicle, shuttle)**	**Name of spacecraft, agency, country**	**Minimum altitude, km**	**Maximum altitude, km**	**Inclination, degrees**	**Orbital period, min**	**Notes**
		"Wosat," Surrey County University, Great Britain	775	801	98.5	100.4	research satellite. Mass 93 kg
		"SARA," France	742	822	98.5	100.2	purpose of satellite not announced
		"Datasat," privately owned, United States	776	803	98.1	100.4	communications satellite. Mass about 15 kg
July 17. From a B-52 aircraft (13 km over the Pacific Ocean near Monterey, California, United States)	"Pegasus"	7 "Microsat" satellites, U.S. Department of Defense	373	500	82	93	"little" communications satellites. For communications at tactical level. Satellite mass 22 kg
August 2. Kennedy Space Center, United States	Space Shuttle (Atlantis orbiter)	"TDRSS-E," U.S. Department of Defense	close to stationary orbit				fourth repeater satellite for the TDRSS system. Mass 10,000 kg, nominal operational life 10 years
August 17. Kourou Space Center, French Guiana	Ariane-44L	"Intelsat-6," ITSO international commercial consortium	close to stationary orbit				sixth-generation commercial communications satellite. Mass 4,226 kg
August 25. Tanegashima Space Center, Japan	"N-1"	"BS-3B," NASDA, Japan	close to stationary orbit				third-generation direct television broadcasting satellite
August 29. Baykonur Cosmodrome, USSR	Vostok	"IRS-15," ISRO (Indian Committee for Space Research), India	872	914	99	102.8	remote sounding satellite
August 30. Kagoshima (Uchinoura) Space Center, Japan	M-3S-2	"Solar-A," ISES (Institute of Space and Astronomical Research), Japan	517	792	31.4	97.6	research satellite for observation of solar flares
September 12. Kennedy Space Center, United States	Space Shuttle (Discovery orbiter)	"UERS," NASA, United States	568	575	57	96	satellite for researching upper layers of the atmosphere. Mass 6,800 kg, length 9.8 meters, diameter 4.6 meters
September 27. Kourou Space Center, French Guiana	Ariane-44L	"Anik-E1," Telesat governmental corporation, Canada	close to stationary orbit				national communications system satellite

Table of Spacecraft Launches Abroad in 1991 (Continued)

			Initial parameters of orbit				
Date and place of launch	**Means of ascent (launch vehicle, shuttle)**	**Name of spacecraft, agency, country**	**Minimum altitude, km**	**Maximum altitude, km**	**Inclination, degrees**	**Orbital period, min**	**Notes**
September 30. Kourou Space Center, French Guiana	Ariane-44L	"Intelsat-6," ITSO international commercial consortium	close to stationary orbit				commercial communications satellite. Launch mass 4,200 kg, height of cylindrical body 11.8 meters, diameter 3.6 meters, nominal operational life up to 14 years
November 8. Western Test Range, United States	Titan-4	secret satellite, U.S. Department of Defense	332	612	63.5	93.18	presumably a Lacrosse radar surveillance satellite
November 24. Kennedy Space Center, United States	Space Shuttle (Atlantis orbiter, IUS booster unit)	"DSP," U.S. Department of Defense	close to stationary orbit				missile-attack warning satellite system. Mass 2,355 kg, maximum height 9 meters, maximum lateral dimension 4.2 meters, nominal operational life 5—7 years
November 28. Western Test Range, United States	Atlas-E	"DMSP," U.S. Department of Defense	843	873	101.9	98.9	military weather reconnaissance satellite. Mass 517 kg, diameter 1.52 meters, height 5.18 meters, nominal operational life up to 18 years
December 7. Kennedy Space Center, United States	Atlas-2	"Etoilesat-2," Western European Etoilesat consortium	close to stationary orbit				commercial communications satellite. Launch mass 1,625 kg, diameter of body 2.5 meters, nominal operational life up to 10 years
December 17. Kourou Space Center, French Guiana	Ariane-44L	"INMARSAT-2," INMARSAT international consortium	close to stationary orbit				satellite intended for supporting communications for maritime vessels and aircraft. Launch mass 1,162 kg, dimensions 2.55 x 1.86 x 1.48 meters, nominal operational life 10 years
		"Telecom-2A," France Telecom agency, France	close to stationary orbit				commercial communications satellite. Launch mass 1,170 kg, height 2.94 meters, diameter 2.18 meters, nominal operational life 7 years

Soviet Advisor Recounts Tactics of Early Air War in Vietnam

93UM0103J Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 7, Jul 92 (signed to press 14 Jun 92) pp 42-43

[Article by Major-General of Aviation (Retired) M.I. Fesenko under the rubric "Aviation in Local Wars": "The Vietnam Syndrome"]

[Text] *Whatever the Soviet missile troops were doing during the period of U.S. aggression against that country, one thing is known for certain: three American fighter/bombers were shot down at once on 24 Jun 65 by an S-75 battalion under the command of Major F. Ilinykh. They were moreover shot down in masterly fashion—by one missile (it smashed into an aircraft in the lead group, the fragments of which struck two other aircraft). The Vietnamese were at first just watching the combat work of our specialists, imitating their experience.*

Soviet MiG-21 interceptors were also present in Vietnam. They were supplied by sea in disassembled form, assembled on the scene by our technicians and test-flown by our pilots, who then trained their Vietnamese colleagues in waging aerial battle in flights dual trainers. Their functions were restricted to that. There could be no discussion of the participation of Soviet pilots in combat sorties—Moscow had imposed a most strict ban on that. Some military specialists in the United States (and not they alone) were meanwhile lost in conjecture—how could the Vietnamese pilots, whose "daily ration was a pinch of rice," could master the MiG-21 so quickly and successfully wage aerial skirmishes with the crews of the Phantoms?

[Major-General of Aviation (Retired) Mikhail Ilich Fesenko, a Hero of the Soviet Union who was in Vietnam in the capacity of advisor to the commander-in-chief of the Air Forces of the VPA [Vietnamese People's Army] from October 1972 through November 1973—that is, at the height of the air war in Southeast Asia—talks about how the Vietnamese pilots were in reality trained and fought, and how we trained them for it.

A One-Sided Game

On 4 Aug 64 the United States, following in the wake of the program of Vietnamization aimed at reinforcing and stabilizing the puppet regimes in South Vietnam, Cambodia and Laos, provoked the Gulf of Tonkin incident with the aim of finding grounds for extending their aggression onto the territory of the DRV [Democratic Republic of Vietnam]. The Americans accused the DRV of attacking the destroyer Maddox with their torpedo boats outside their territorial waters, and on August 5 U.S. air power made the first strikes against targets in North Vietnam. Thus did the prolonged air war in Indochina begin. Four periods in it can be delineated.

The **first stage (February—July 1965)** was characterized by systematic mass bombardments by the air power of the aggressor and by only occasional sorties by North Vietnamese fighters to "repel the raids." This one-sided game was conditioned by the patent inequality of forces: the United States had concentrated 330 tactical fighters at airfields in Thailand, 30 B-52 strategic bombers on the island of Guam and 20 KC-135 tanker aircraft on the island of Okinawa by the start of combat operations. There were also more than 200 carrier-based fighters and attack aircraft on three aircraft carriers plying the waters of the South China Sea.

The Air Forces and air defense of the VPA, at the same time, possessed only 25 MiG-17 fighters and a few battalions of anti-aircraft artillery covering the major administrative centers of North Vietnam, Hanoi and Haiphong. It was thus no accident that the American air command, without burdening themselves with the development of intricate plans, kept to so-called practice-range tactics in carrying out their air attacks. Groups of aircraft (the number in one sortie could sometimes reach 80 aircraft) flew toward the target at altitudes that were favorable for navigation and the maintenance of "formation" (on the order of 2,500—4,000 meters); when attacking ground targets the crews used the simplest of methods for bombing and launching non-guided rockets, while the comparatively poor quality of weapons delivery was wholly compensated for by the quantity of ordnance dropped on the target (there was no necessity of the economical expenditure of resources, insofar as there was an abundance of them); the crews simply did not descend into the lethal zone of the anti-aircraft artillery in order to avoid getting the aircraft hit by them, and in cases of opposition from the subsonic MiG-17s, they threw up a dense fighter screen (the American pilots demonstrated what they were taught during peacetime).

"Open" actions by handfuls of North Vietnamese fighters against superior enemy forces were ruled out under these conditions. The classic variation for air cover—"intercept in the distant approaches to the targets being protected"—also did not have the requisite effect. Only one thing remained—to attack the enemy at a moment when it would be difficult for him to repel it.

The American journal ORDNANCE wrote on this score that "Our strike F-105s were vulnerable in flight with an ordnance load, which took up all of the weapons racks. The heavy frontal resistance led to limitations on flight speeds, which did not exceed 890 km/hr. The MiG-17s demonstrated their concealed advantages in such situations—light and maneuverable, they were positioned at low altitude in the close approaches to the targets being protected and, concealing themselves against the background of the ground, they awaited the approach of the main strike group. When it was detected they went out into the ambush and, making use of their small advantage in speed, attacked the inert F-105s, shooting them up point-blank."

It was just that tactic that was used by the North Vietnamese pilots who destroyed an American supersonic fighter/bomber on 4 Apr 65. Another three F-105s and a pair of carrier-based attack aircraft were shot down

after that. Clear "holes" had been found in the practice-range tactics of the Americans: the raids by the aggressor on Hanoi and Haiphong were no longer with impunity—the Vietnamese pilots in the MiG-17s continued to operate rarely, but well.

The **second stage (July—October 1965)** introduced substantial corrections into the course of the aerial warfare with the appearance of the Soviet S-75 guided anti-aircraft missile systems in the VPA air-defense system, which engaged the aggressor aircraft with great effectiveness. The sharply increased number of combat losses forced the Americans to repudiate conclusively the tactics they had selected earlier, which had justified themselves only in the face of weak resistance on the part of the obsolete firepower of the North Vietnamese air defenses.

We turn again to the journal ORDNANCE, which described the change in the situation thus: "The guided missiles of the S-75 systems struck the aerial targets with high effectiveness right in the range of medium altitudes where American air power had 'ruled.' A drop to low altitude (where the detection and guidance radar of the air defenses became 'blind') seemed to provide a certain chance of evading the missiles that were launched. Flight at the ground, however, increased the likelihood of being hit by the fire of the cannon artillery that was disposed in dense battle formations in the areas of the targets being defended."

The American air command naturally felt it necessary to choose the lesser of two evils—the practice-range tactics were replaced with low-altitude tactics. This reorientation was reflected immediately in the conditions of waging armed battle—it became much more difficult for the North Vietnamese fighters to obtain trustworthy information on enemy aircraft flying along the ground; the organization of MiG-17 ambushes, which had justified themselves in a situation of regular flights by the aggressor at a strictly appointed time, was constantly being being disrupted; the effectiveness of attacks against freely maneuvering targets was reduced considerably.

The low-altitude tactics nonetheless did not fully justify themselves; the power of the strikes being inflicted by groups of aircraft that were small in composition was sharply lessened with their adoption, after all, and the losses from the fire of anti-aircraft artillery increased. The time for the next "change of scenery" had come.

The **third stage (February 1966—March 1968)** was marked by a qualitative leap in the use of air power in aerial warfare by both sides, which was largely facilitated by the transition of the Americans to a combination of low-altitude "incursions" by small groups of aircraft in echelons with mass strikes from medium altitudes (the latter had become possible thanks to the active use of electronic warfare) and the fact of the appearance of the Soviet-produced MiG-21 fighter in service with the VPA Air Forces (the first battle with its participation was on 23 Apr 66). The U.S. Air Force command in reply began missions to cover the strike groups using F-4 Phantom aircraft, which had an indisputable advantage over their predecessor the F-105 in waging aerial battles.

If one were to compare the analogous capabilities of the MiG-21 and the F-4 aircraft, it could be said that they did not differ markedly (which could not be said, for example, about the MiG-17 and F-105 pair). The first clashes in the air by the crews of these aircraft showed that the MiG-21 had somewhat of a superiority over the Phantom in maneuvering at high altitudes and low speeds (despite the smaller thrust-to-weight ratio) due to its lesser unit load on the wing compared to the F-4 (342 and 490 km/m^2 respectively). The North Vietnamese pilots, proceeding from that, began to get engaged in close-quarters battle without any misgivings. They preferred the tactics of "a series of missile attacks," however, in cases where the enemy held a numerical advantage.

Here is what was reported on a confrontation that was joined between these aircraft by the magazine AVIATION WEEK AND SPACE TECHNOLOGY: "The MiG-21 deprived the Phantoms of the effects of numerical superiority through the launch of guided missiles from the rear hemisphere at speeds of Mach 1.2. This tactic, which demanded great pilot skill and competent vectoring from the command post, was quite effective and ensured the invulnerability of the attacker."

The Americans also did not fail to note the distribution of efforts between the two types of enemy fighters in group battle: "The North Vietnamese are very flexible in a tactical regard. The subsonic MiG-17s, gravitating toward comparatively low altitudes, displace our bombers upward, where they encounter missile attacks from the MiG-21s."

Whereas 11 American aircraft of various types and 9 North Vietnamese MiG-17s were shot down in aerial battles over the first four months of 1966 (a ratio of 1.2:1), the picture of the confrontation in the air was sharply altered with the "entry into battle" of the MiG-21; the United States lost 47 aircraft and the DRV only 12 of its own (4:1) from May through December.

This fact, which testifies to the increased combat proficiency of the Vietnamese pilots, forced the aggressor to take immediate steps—the fighter pilots whose flying time had reached 1,500—2,000 hours were sent to special bases in the United States for retraining, the dense and extensive program for which included half-forgotten aerobatic maneuvers "at the edge," the integrated use of cannon and missile armaments, the practicing of standard tactical maneuvers and group aerial dogfighting with "enemy" aircraft (fighters, bombers and attack aircraft).

The first group of pilots who had mastered the tactics of waging "modern forms of warfare" returned to Vietnam in the fall of 1967. Their increased professionalism undoubtedly could not help but be reflected in the

substance and results of aerial battles as well. According to data of the Vietnamese command, some 124 American aircraft were shot down with the loss of 60 of their own in 1967. The loss ratio of 2:1—which had been recorded, by the way, as early as the start of the war in the air—was thus restored, and was facilitated by the constant changes in the operational tactics of the opposing sides: effective defensive measures were always being sought to the new variations for aerial attack. It was thus no accident that in the fall of 1968, after the loss of three out of the six F-111A fighter/bombers that had been sent to Vietnam to check out their combat capabilities, a temporary lull ensued in the skies over Vietnam; it had become clear to the American command that its efforts aimed at putting the latest models of aircraft into battle and making combat operations more active through increasing the number of raids in targets in the DRV by tactical fighters from the Air Force and Navy were not having the expected results.

The principal causes that led to a decline in the operational effectiveness of American air power, in the opinion of foreign specialists, consisted of the following. First, while they were able to train the pilots in the waging of maneuverable aerial battle, it proved to be quite difficult to "fit" an "unmaneuverable" aircraft to it; the crew of the "heavy" Phantom could only evade enemy attacks through the execution of a steep banked turn, having no opportunity therein to take up a tactically advantageous position for a reciprocal attack (due to the greater radius and time for a turn compared to the MiG-21). The drawbacks of the hardware were thus only partly compensated for by the level of pilot training.

Second, the conditions for the performance of the mission of escorting bombers to the strike target constrained the actions of the F-4 pilots; they could not allow themselves to quit the strike group they were covering and get into a prolonged battle with enemy fighters, but were rather "doomed" only to repelling their attacks.

Third, the Vietnam pilots were able to "thrust" their own scheme of battle—structured according to the type of intercept—onto the enemy, which forced the Americans to operate in a defensive key and resort to going over complex maneuvers—which were not sufficiently effective, however—in order to switch to the attack.

As for an assessment of the operations of VPA fighter aviation during this period, it continued in general to repel the enemy air strikes successfully, adhering therein to the principles of combat activeness, surprise and the economical expenditure of force. *(To be continued.)*

Articles Not Translated

00000000 Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 7, Jul 92 (signed to press 14 Jun 92)

[Text]

Living Witnesses of War (Ya. Yanchak) c2

Do You Consider Yourself a Professional? (Major A. Ziziko *et al.*) 2-3

Letters From Readers 8-9

Air Aces (P. Bogdanov, A. Shcherbakov) 16-17

The Winged Border Post Keeps the Peace (Colonel V. Novikov, Lieutenant-Colonel A. Klepikov) 22

The Front Line Ran Through the Soldiers' Hearts... (Lieutenant-Colonel (Retired) F. Barsukov) 23

Werewolves on the Hardstand (Colonel (Retired) A. Krasnov) 26-27

Designer of the "Aircraft-Flight" (N. Yakubovich) 28-29

The Wings of Russia (V. Tkachev) 30-33

Bookshelf: Meteorology for the Helicopter Pilot 33

Mythology and Power Engineering (A. Tarnovskiy) 38-39

KOSMINFORM 39

"Flights" on Earth (Colonel (Retired) A. Drozhzhin) ... 44-45

"Luftwaffe-4" (Lieutenant-General J. Küwart) ... 46-48

Advertisement for Aviabank c4

Publication Data

93UM0103L Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 7, Jul 92 (signed to press 14 Jun 92)

[Text]

English title: AVIATION AND COSMONAUTICS

Russian title: AVIATSIYA I KOSMONAVTIKA

Editor: V.V. Anuchin

Publishing house: Voyenizdat

Date of publication: July 1992

Signed to press: 14 Jun 92

NTIS
ATTN PROCESS 103
5285 PORT ROYAL RD
SPRINGFIELD VA 22161

2

BULK RATE
U.S. POSTAGE
PAID
PERMIT NO. 352
MERRIFIELD, VA.

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